

## Manifestation of the Structure Ordering of Ethylene Glycols in Their Raman Spectra

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Polarization Raman spectra of aqueous solutions of ethylene glycols with a polymerization degree  $n = 1-3$  are studied in the range of CH vibrations. The spectra of ethylene glycols studied in this work exhibit several broad bands in the  $2700-3100\text{ cm}^{-1}$  range. Traditionally, these broad bands in Raman spectra are attributed to formation of a cluster structure that motivates the quasi-ionic nature of vibration spectra. The bandwidth of CH vibrations observed in our experiments was  $60-70\text{ cm}^{-1}$  for all samples. Experiments with picosecond pulse excitation have shown that homogeneous broadening (all spectrally active molecules are under nearly identical conditions) of the ethylene glycol band's frequency at  $2935\text{ cm}^{-1}$  is about  $3\text{ cm}^{-1}$ . We can reasonably assume that likewise in amorphous polymers, there is a fairly large number of differently arranged and ordered clusters in ethylene glycol solutions.

The high-frequency shift and redistribution of the spectrum intensity are attributed to Fermi resonance. The nonlinear concentration dependence of the coupling parameter provides proof of the existence of a common energy transfer system. When the intermolecular energy exchange dominates, this dependence should be nonlinear; this was observed in our experiments. Because of the presence of long-lived H-bonds cross-linking the molecules, intermolecular energy transfer dominates over intramolecular energy transport. The high ordering is shown to persist even in dilute solution.